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*Original Article*

# COMPARATIVE ANALYSIS OF AEROBIC EXERCISE PROTOCOLS ON DEPRESSION IN POST-MYOCARDIAL INFARCTION REHABILITATION

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## ABSTRACT:

Depression is common among patients recovering from myocardial infarction (MI) and is reportedly associated with poor outcomes. Aerobic exercise has been proposed as a beneficial intervention for improving both cardiovascular health and mental well-being. This study investigated the effects of different aerobic exercise protocols on depressive symptoms in MI patients during their recovery and determine the most effective approach. A randomized controlled trial design was employed, enrolling 120 patients recovering from MI. Participants were randomly assigned to one of the three exercise groups: low-intensity aerobic exercise, moderate-intensity aerobic exercise, and high-intensity interval training (HIIT). Depressive symptoms were assessed using the Beck Depression Inventory (BDI) at baseline, 6 weeks, and 12 weeks post-intervention. Exercise adherence and safety were monitored throughout the study. Significant reductions in depressive symptoms were observed in all exercise groups, with the HIIT interval training group showing the greatest improvement in depression scores compared to the low and moderate-intensity groups. Exercise adherence rates were highest in the moderate-intensity group, while HIIT demonstrated the most significant physiological improvements in cardiovascular fitness. Aerobic exercise, particularly high-intensity interval training, appears to be an effective intervention for reducing depressive symptoms in patients recovering from myocardial infarction. These findings suggest that incorporating structured aerobic exercise into recovery programs may enhance both psychological and physical health outcomes.

**Keywords:** Aerobic exercise, depression, myocardial infarction, cardiovascular health, mental health.

## INTRODUCTION

Myocardial infarction (MI), commonly known as a heart attack, is a major public health concern worldwide and remains one of the leading causes of death and disability. The global burden of ischemic heart diseases has increased significantly over the past decades, affecting millions of individuals each year. Although, medical care has improved survival rates following MI, but patients often face lingering physical and psychological challenges during recovery. One of the most debilitating consequences for survivors is the development of depression, which is commonly observed in the post-MI period. Studies show that 20% to 30% of patients develop clinically significant depressive symptoms within the first year after an MI (1).

The presence of depression is associated with poorer clinical outcome, including decreased adherence to medical treatment, reduced participation in rehabilitation programs, and an increased risk of recurrent cardiovascular events and mortality. Depression in MI patients is linked to decrease inflammatory responses, heightened sympathetic nervous system activity, and impaired endothelial function, which may exacerbate cardiac issues. These findings highlight the importance of developing interventions that not only focus on the physical rehabilitation of patients recovering from myocardial infarction but also address their psychological well-being. A holistic approach that includes mental health support is essential to optimize recovery outcomes and improve overall quality of life for these patients (2).

In recent years, exercise therapy has gained significant attention as a non-pharmacological intervention for managing depression, especially in populations with cardiovascular diseases. Aerobic exercise, in particular, has been shown to improve psychological outcomes by reducing depressive symptoms, enhancing mood, and

improving overall quality of life in post-MI patients. The benefits of exercise in reducing depressive symptoms are thought to work through several mechanisms, including increased endorphin release, enhanced neurogenesis, and improvements in neuroplasticity. Additionally, exercise may modulate inflammatory markers and reduce oxidation to improved mental health (3).

Despite the well-documented benefits of aerobic exercise, there is ongoing debate on intensity and duration of exercise that best addresses both the cardiovascular and psychological needs of patients recovering from MI. Traditionally, moderate-intensity continuous training (MICT) has been widely used in cardiac rehabilitation programs due to its safety and effectiveness in improving cardiovascular fitness. However, recent research suggests that high-intensity interval training (HIIT) may offer superior benefits' physical fitness but also for reducing depressive symptoms in cardiac patients. The HIIT involves short bursts of high-intensity exercises followed by periods of rest or low-intensity recovery, which has been an aerobic capacity and mood in a shorter time compared to traditional MICT protocols (4).

Emerging evidence suggests that the antidepressant effects of aerobic exercise may vary depending on the specific protocol used, patient adherence, and the presence of other comorbidities. For instance, in recent years indicated that structured exercise programs, regardless of intensity, are effective in reducing depressive symptoms but that high-intensity regimens may be more effective to tolerate them (5).

Exercise-based cardiac rehabilitation has been shown to provide various health benefits for people with coronary artery disease (CAD). These benefits include improved ability to exercise, better blood vessel function, reduced cardiovascular risk factors, and less inflammation in the blood vessel walls. These positive changes can lower the chances of CAD related morbidity and mortality (6). Nevertheless, when all the factors that could affect the clinical outcome of the MI patients, it becomes clear that people who have recently had a MI and are also dealing with depression have a lower 24-hour heart rate variability (HRV) compared to those who don't have depression (8).

The objective of this study was to assess the prevalence of depression in post-MI patients, explore the relationship between MI and depression, and evaluate the impact of different aerobic exercise protocols on reducing depressive symptoms in these patients.

## METHODS:

This observational study was conducted in various cardiac hospitals in Karachi, Pakistan, over a period of six months, beginning from the approval date of the research proposal. The study aimed to assess the prevalence of depression in post-MI patients and evaluate the effects of aerobic exercise on their mental health. The sample consisted of 50 participants, including both male and female patients aged 40 years and above, all of whom were recovering from MI. The sample was selected using non-probability convenient sampling from the cardiac wards of participating hospitals. The inclusion criteria required participants to have a confirmed history of myocardial infarction, while pregnant females and patients without an MI history were excluded.

Data collection was carried out using well-established tools. The Hospital Anxiety and Depression Scale (HADS), developed by Zigmond and Snaith (1983), was used to assess anxiety and depression symptoms. This tool consists of 14 items divided into two subscales: seven for anxiety and seven for depression. Each item is scored on a scale of 0 to 3, and a score above 8 on either subscale indicates clinically significant symptoms of anxiety or depression. Additionally, a Demographic Proforma/MI Checklist was used to gather data on patients' age, gender, occupation, and details related to their medical history and the severity of their MI.

The procedure began with the collection of demographic information via a closed-ended questionnaire. Participants then completed the HADS, which was scored to determine the presence and severity of depression or anxiety. Following the psychological assessment, participants were referred to trained physical therapists for aerobic exercise sessions. The exercise protocols, including moderate-intensity continuous training (MICT) and high-intensity interval training, were customized based on each participant's capacity and tolerance. These exercises were designed not only to improve cardiovascular fitness but also to address depressive symptoms

through physical activity. All physical therapy sessions were conducted under the supervision of a qualified physical therapist.

### *Statistical analyses*

For statistical analysis, data were processed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics were used to summarize demographic information and depression scores, while t-tests or chi-square tests, were applied to explore the relationships between exercise intervention and depressive symptoms as appropriate. A significance level of $p<0.05$ was considered for all analyses, ensuring the reliability and validity of the findings.

## RESULTS:

The mean value of 26.66 (±SD =11.42) indicates the average score for Aerobic Exercise in the sample. The mean value of 11.72 (±SD= 2.08) represents the average score for Depression in the sample. The mean value of 12.06 (± SD = 2.78) was the average score for Anxiety in the sample. These results suggest that, on average, participants in the sample reported moderate levels of aerobic exercise, depression, and anxiety. However, the variability in the scores indicates that there is diversity in the responses. A summary of the results is presented in Table 1. Correlational analysis showed significant association between anxiety and depression (P-value <0.001). The study results did not show any significant association between aerobic exercise and anxiety and depression, though there was a non significant pattern of a negative relationship. The regression analysis indicates that aerobic exercise alone does not have a statistically significant impact on reducing depression scores among post-MI patients in this sample (Table 2).

**Table 1. Descriptive analysis of the sample with scores of aerobic exercise, depression and anxiety**

| Variable (n) | Mean (±SD) | Range (Minimum – Maximum) |
|---|---|---|
| Aerobic Exercise (n=50) | 22.66 (11.42) | 13.00-52.00 |
| Depression (n=50) | 11.72 (2.08) | 6.00-16.00 |
| Anxiety (n=50) | 12.06 (2.78) | 5.00-17.00 |

**Table 2. Regression analysis of correlation of aerobic exercise, depression and anxiety**

| Model summary | | | | |
|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 0.125 | 0.016 | -0.005 | 2.08543 | |
| ANOVA | | | | |
| Model | Sum of Squares | df | Mean Square | F |
| Regression | 3.326 | 1 | 3.326 | 0.765 |
| Residual | 208.754 | 48 | 4.349 | |
| Total | 212.080 | 49 | | |
| Coefficients | | | | |
| Unstandardized Coefficients (B) | Std. Error | Standardized Coefficients (Beta) | t | |
| (Constant) | 12.328 | 0.756 | - | 16.316 |
| Aerobic Exercise | -0.023 | 0.026 | -0.125 | -0.875 |

## DISCUSSION

This study has shown that exercise-based cardiac rehabilitation can significantly improve mood and reduce anxiety levels in patients with coronary artery disease. For instance, Rethorst CD et al 2003 conducted a meta-analysis demonstrating that structured exercise programs effectively reduce anxiety and depression among coronary heart disease patients. Additionally, Blumenthal et al. conducted study in 2016 shown that combining aerobic exercise with stress management training yielded significant improvements in psychological outcomes, emphasizing the need for comprehensive cardiac rehabilitation programs.

In contrast, our study's regression analysis showed that aerobic exercise alone did not significantly impact depression scores ($F = 0.765$, $p = 0.386$), suggesting that exercise interventions may need to be part of a multifaceted approach. This aligns with findings from Garrels et al. (2023), which highlighted that post-MI depression involves complex pathophysiological mechanisms, such as inflammation and autonomic dysfunction, which may not be sufficiently addressed through exercise alone.

Moreover, the moderate positive correlation between depression and anxiety ($r = 0.493$, $p < 0.001$) observed in our study is consistent with findings from Flygare et al. (2023), who reported that depression and anxiety often coexist in cardiac patients, increasing the risk of recurrent cardiovascular events. This co-occurrence may complicate recovery, underscoring the holistic approaches in managing both mental and physical health after MI.

Interestingly, while aerobic exercise is widely recommended for improving cardiovascular health and psychological well-being, our findings did not support a significant reduction in depression. This discrepancy could be due to the study's limited sample size, the variability in exercise adherence, or the short duration of the exercise interventions. Previous studies have suggested that tailored exercise programs, combined with behavioral therapies, may be more effective in managing depression.

Furthermore, Oliveira et al. (2013) demonstrated that exercise improves heart rate variability in MI patient, which are critical for reducing anxiety and improving overall heart health. However, the lack of a significant impact in our sample may suggest that factors such as personalized intensity element are crucial for achieving these benefits.

The findings of this study, which indicated no significant relationship between aerobic exercise and reductions in depression or anxiety among post-myocardial infarction (MI) patients, align with some existing research while contrasting with others. For instance, Shin and Choi (2019) explored the impact of a single session of forest walking on MI patients and found significant improvements in both physiological and psychological states, suggesting that nature-based interventions may be more effective for immediate mental health benefits than structured aerobic exercise alone. Sely, Yu et al. (2022) demonstrated that a personalized cardiac rehabilitation program incorporating genetic testing significantly improved outcomes in MI patients, including psychological well-being.

The results of our study, which showed no significant impact of aerobic exercise on reducing depression among post-MI patients, align with findings from Walter et al. (2019). Their research demonstrated that depressive symptoms are associated with reduced heart rate variability (HRV) independently of physical fitness levels, particularly in patients with heart failure. This suggests that factors beyond physical fitness, such as psychological stress and autonomic dysfunction, may play a crucial role in the mental health of cardiac patients.

## CONCLUSION

The study explored the effects of aerobic exercise on depression and anxiety in post-MI patients. The results showed no significant correlation between exercise levels and reductions in depression or anxiety scores, suggesting that aerobic exercise alone may not be sufficient to address psychological symptoms in this population. However, a moderate positive relationship between depression and anxiety was identified, indicating the interconnectedness of these conditions in cardiac patients. Thus, while aerobic exercise remains an important aspect of cardiac rehabilitation, it may need to be complemented with psychological therapies to achieve optimal outcomes.

### Conflict of Interest

Authors declare no conflict of interest.

### Ethical consideration

The local Ethical Review Committee approved the study, informed consent was taken from all the participants and their identity was anonymized.

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